

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 0 911 952 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
05.04.2000 Bulletin 2000/14

(51) Int Cl.7: H02N 1/00

(43) Date of publication A2:
28.04.1999 Bulletin 1999/17

(21) Application number: 98308766.9

(22) Date of filing: 27.10.1998

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(72) Inventors:
• Taussig, Carl P.
Redwood City, California 94061 (US)
• Elder, Richard E.
Palo Alto, California 94306 (US)

(30) Priority: 27.10.1997 US 958635

(74) Representative: Powell, Stephen David et al
WILLIAMS, POWELL & ASSOCIATES
4 St Paul's Churchyard
London EC4M 8AY (GB)

(71) Applicant: Hewlett-Packard Company
Palo Alto, California 94304 (US)

(54) Electrostatic actuator

(57) An electrostatic actuator (10) uses two-dimensional in-plane motion of a monolithic element suspended by flexures which is unstable in the open-loop and uses feedback control to operate. By adding a common bias voltage to each of the stator electrodes (20, 22, 24, 26) when the translator (14) and stator (12) are in the unstable equilibrium position, repulsion can be reduced to zero while the in-plane force remains in unstable equilibrium. Stabilizing the in-plane force at the unstable equilibrium position is achieved by shifting the electrical phase of the stator potential distribution in a direction to produce an in-plane force which opposes motion of the translators away from equilibrium position. Linear control and pulse width modulation control permit altering the phase by less than the stator pitch. The drive electrodes of the translator and stator are used as position sensors for in-plane and out-of-plane relative displacements of the translator and stator concurrent with operation of the motor using either pulse-width modulation or linear control.

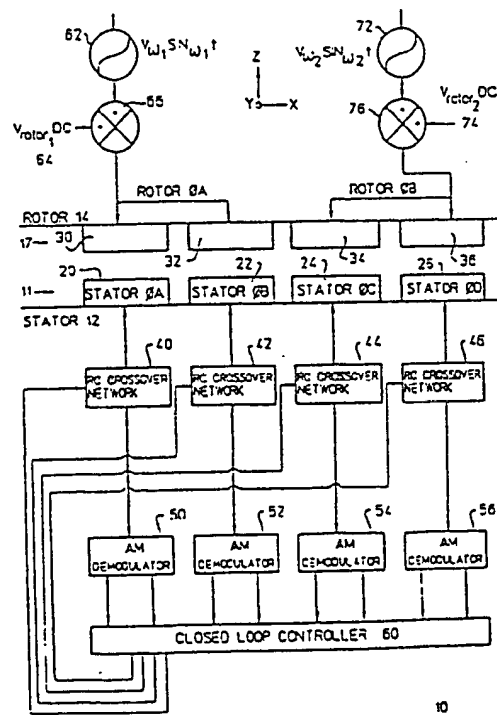


Figure 1

EP 0 911 952 A3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 30 8766

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US 5 477 097 A (MATSUMOTO HIROFUMI) 19 December 1995 (1995-12-19)		H02N1/00
A,D	US 5 534 740 A (HIGUCHI TOSHIRO ET AL) 9 July 1996 (1996-07-09)		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H02N
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		15 February 2000	Ramos, H
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background D: non-written disclosure P: intermediate document</p> <p>T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/82 (P04001)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 98 30 8766

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-02-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5477097 A	19-12-1995	JP 2700991 B	21-01-1998
		JP 7123742 A	12-05-1995
US 5534740 A	09-07-1996	JP 6022562 A	28-01-1994
		DE 69218351 D	24-04-1997
		DE 69218351 T	26-06-1997
		EP 0546186 A	16-06-1993
		WO 9222125 A	10-12-1992

EPO FORM P4429

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82